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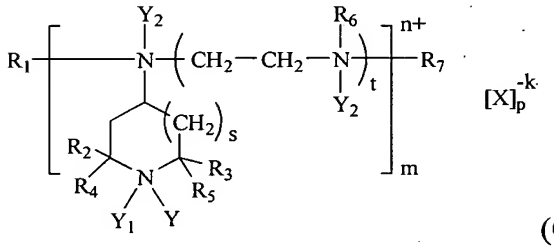
CLAIM AMENDMENTS

A complete set of the claims showing status identifiers and amendments is set out hereinafter.

1. (original) A method for the production of light-stable and process-stable lignocellulosic materials such as mechanical wood pulps comprising the reaction of these materials in an aqueous medium, in an alkaline peroxide bleaching medium, or in an aqueous medium with a subsequent bleaching of the materials in an alkaline peroxide bleaching medium, with a water-soluble, yellowing inhibitor or hindered amine light stabilizer possessing two or more secondary and/or tertiary amino or ammonium, and/or quaternary ammonium groups of the general formula (O):



(O)

wherein s is 0 or 1;
k is an integer of 1 to 5,
n is an integer of 0 to 5002, more preferably 0 to 502, even more preferably 0 to 52, and most preferably 0 to 12;
m is an integer of 1 to 5,
t is an integer of 1 or more, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;

p is an integer of 0 to 5002, more preferably 0 to 502, even more preferably 0 to 52, and most preferably 0 to12; provided that when n is 0, p is 0, m is 1, and both Y_1 and Y_2 are absent;

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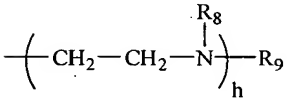
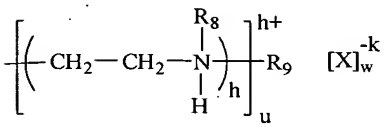
Y is oxyl (O·), hydroxyl (OH) or hydrogen (H), and Y_1 is hydrogen or absent, provided that when Y_1 is hydrogen, Y is hydroxyl;
Y_2 is hydrogen or is absent, provided that when Y_2 is hydrogen, n = t + 1 or t + 2, and when Y_2 is absent, n is 0 or 1
R_2, R_3, R_4 and R_5 are independently alkyl groups $(CH_2)_jH$ unsubstituted or substituted by 1 to a (2j+1) number of substituents, selected from hydroxyl, mercapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or a radical derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by 1 to j number of heteroatoms selected from –O- and –S-, wherein j is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;.
R_1 is hydrogen or an ethylene amino or ammonium group of formula (I) or (J);
when $t \geq 2$, R_6 and R_7 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
when t = 1, R_6 is hydrogen and R_7 is a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N):



(I)



(J)

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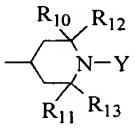
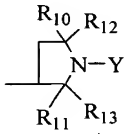
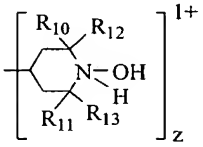


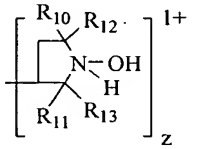
(K)



(L)



(M)



(N)

wherein $h \geq 1$, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
X is the same as defined above;
k is 1 to 5,
w is ≥ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10,
u = 1 to 5, the total charge kw = hu in formula (J);
R_8 and R_9 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
R_{10}, R_{11}, R_{12} and R_{13} are independently alkyl groups $(CH_2)_iH$ unsubstituted or substituted, by 1 to a (2i+1) number of substituents selected from, hydroxyl, mecapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or radicals derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by i heteroatoms selected from –O- and –S-, wherein i is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;

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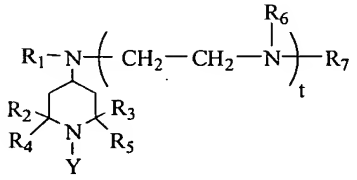
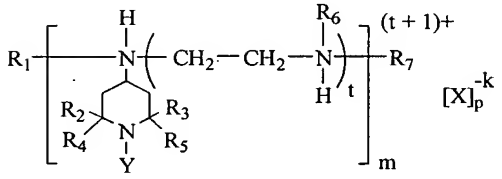
X is the same as defined above; k is 1 to 5, y is 1, z is 1 to 5, the total charge ky = z in formula (M) or (N); Y is oxyl ($O^{\cdot}$), hydroxyl (OH) or hydrogen (H).

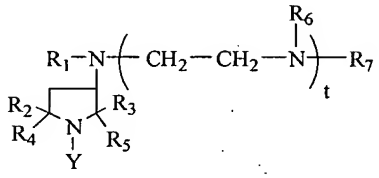
2. (original) A method according to claim 1 wherein formula (O) is of a water-soluble, yellowing inhibitor possessing two or more secondary and/or tertiary amino or ammonium groups, and/or quaternary ammonium groups of the formula (A), (B), (C), (D), (E), (F), (G) or (H) wherein Y is oxyl ($O^{\cdot}$) or hydroxyl (OH) and the reaction is in an aqueous medium, or formula (O) is of a a water-soluble, fibre-reactive hindered amine light stabilizer of the formula (A), (B), (C) or (D) wherein Y is hydrogen (H) and the reaction is in an alkaline peroxide bleaching medium or in an aqueous medium with a subsequent bleaching of the materials in an alkaline peroxide bleaching medium:



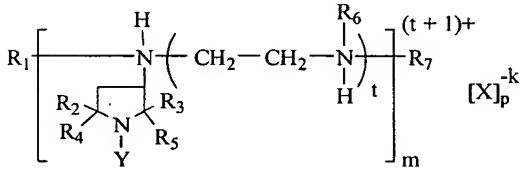
(A)



(B)



(C)



(D)

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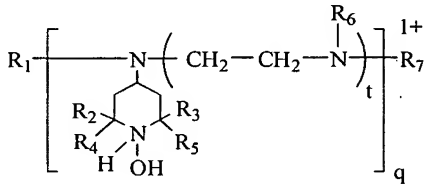
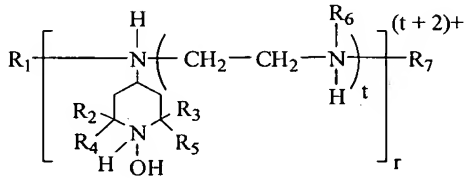
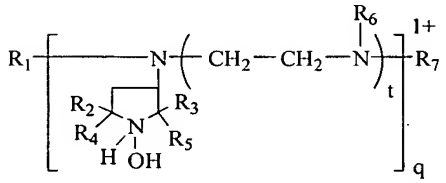


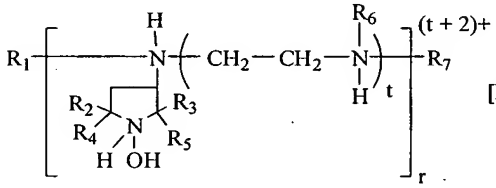
$[X]_p^{-k}$ (E)



$[X]_p^{-k}$ (F)



$[X]_p^{-k}$ (G)



$[X]_p^{-k}$ (H)

wherein R_2, R_3, R_4 and R_5 are independently alkyl groups $(CH_2)_jH$ unsubstituted or substituted by 1 to a (2j+1) number of substituents, selected from hydroxyl, mercapto, lower alkoxy, lower alkylthio, , benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or a radical derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by 1 to j number of heteroatoms selected from –O- and –S-, wherein j is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;
X is an inorganic or organic anion such as carbonate, bicarbonate, chloride, bisulfate, sulfate, formate, acetate, citrate, phosphate, oxalate, ascorbate, ethylenediaminetetraacetate, or diethylenetriaminepentaacetate;
k is 1 to 5,

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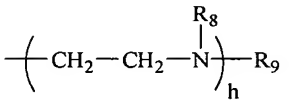
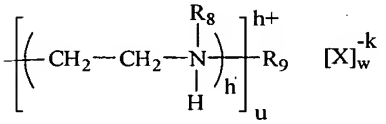
p is an integer of 1 to 5001, more preferably 1 to 501, even more preferably 1 to 51, and most preferably 1 to 11 in formula (B) or (D), p is 1 in formula (E) or (G), and p is 1 to 5002, more preferably 1 to 502, even more preferably 1 to 52, and most preferably 1 to 12 in formula (F) or (H),
m is 1 to 5,
q is 1 to 5,
r is 1 to 5,
the total charge of kp = (t + 1)m in formula (B) or (D), kp = q in formula (E) or (G), and kp = (t + 2)r in formula (F) or (H);
t is $\geq$ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
R_1 is hydrogen or an ethylene amino or ammonium group of formula (I) or (J);
when t $\geq$ 2, R_6 and R_7 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
when t = 1, R_6 is hydrogen and R_7 is a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N):



(I)



(J)

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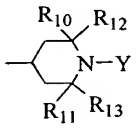
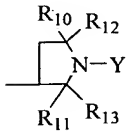
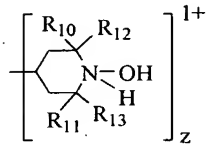


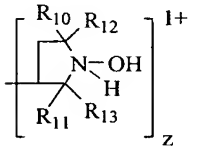
(K)



(L)



(M)



(N)

wherein $h \geq 1$, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
X is the same as defined above;
k is 1 to 5,
w is ≥ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10,
u = 1 to 5, the total charge kw = hu in formula (J);
R_8 and R_9 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
R_{10}, R_{11}, R_{12} and R_{13} are independently alkyl groups $(CH_2)_iH$ unsubstituted or substituted, by 1 to a (2i+1) number of substituents selected from, hydroxyl, mecapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or radicals derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by i heteroatoms selected from –O- and –S-, wherein i is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;

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X is the same as defined above; k is 1 to 5, y is 1, z is 1 to 5, the total charge ky = z in formula (M) or (N); Y is oxyl (O·), hydroxyl (OH) or hydrogen (H).

3. (original) A method according to claim 2 wherein said material is reacted with said yellowing inhibitor in said aqueous medium.

4. (original) A method according to claim 2 wherein said material is reacted with said stabilizer in said alkaline peroxide bleaching medium.

5. (original) A method according to claim 2 wherein said material is reacted with said stabilizer in an aqueous medium with a subsequent bleaching of the reacted material in said alkaline peroxide bleaching medium.

6. (currently amended) A method according to ~~any one of claims 1 to 5~~ claim 1, wherein said lignocellulosic material is a wood pulp and including steps of forming a paper from the resulting pulp and coating the paper with an ultraviolet absorber.

7. (currently amended) A method according to claim 1, ~~2, 3, 4, 5 or 6~~ wherein at least one of the R_2, R_3, R_4, R_5, R_6 and R_7 groups in the said yellowing inhibitors or hindered amine light stabilizers contains an organic ultraviolet absorber derived from, for example, 2,4-dihydroxybenzophenone, 2-hydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole.

8. (currently amended) A method according to ~~any one of claims 1 to 7~~ claim 1, wherein X is selected from carbonate, chloride, bisulfate, sulfate, formate, acetate, citrate, phosphate and ascorbate.

9. (currently amended) A method according to claim 1 ~~or 2~~ wherein the yellowing inhibitor is N-(2,2,6,6-tetramethyl-1-oxyl-piperidin-4-yl)-N'-{2-[2-(2,2,6,6-tetramethyl-1-oxyl-piperidin-4-ylamino)-ethylamino]-ethyl}-ethane-

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1,2-diamine synthesized from a reductive amination of 4-oxo-2,2,6,6-tetramethylpiperidine-N-oxyl with triethylenetetramine in the presence of a reducing agent such as sodium triacetoxyborohydride.

10. (currently amended) A method according to claim 1 ~~or 2~~ wherein the yellowing inhibitor is N-(2,2,6,6-tetramethyl-1-hydroxyl-piperidin-4-yl)-N'-{2-[2-(2,2,6,6-tetramethyl-1-hydroxyl-piperidin-4-ylamino)-ethylamino]-ethyl}-ethane-1,2-diamine hexahydrochloride synthesized from the reductive amination of 4-oxo-2,2,6,6-tetramethylpiperidine-N-oxyl with triethylenetetramine in the presence of a reducing agent such as sodium triacetoxyborohydride, followed by reaction with hydrochloric acid in ethanol.

11. (currently amended) A method according to ~~any one of claims 1 to 10~~ claim 1, wherein the reaction of the lignocellulosic material is conducted with a charge of the yellowing inhibitor or hindered amine light stabilizer of 0.01% to 2.00%, by weight, based on the oven dry weight of the lignocellulosic material.

12. (original) A method according to claim 11 wherein said amount is 0.2% to 1.0%, by weight.

13. (currently amended) A method according to ~~any one of claims 1 to 12~~ claim 1, wherein the reaction is conducted at a temperature of 20 – 120 °C, a consistency of 0.01% - 50%, and a time of 5 seconds to several hours.

14. (currently amended) A method according to claim 1, ~~2 or 3~~ wherein the reaction in an aqueous medium is conducted at a pH of 3.5 – 12.5.

15. (currently amended) A method according to claim 1 ~~or 2~~ wherein a reducing agent or an acid is added to the reaction medium.

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16. (currently amended) A method according to claim 1, ~~2, 3 or 4~~ wherein the material is a pulp and the resulting pulp is treated with a reducing agent or an acid.

17. (currently amended) A method according to ~~any one of claims 1 to 16~~ claim 1, wherein the reaction and/or bleaching is conducted in the presence or absence of air or oxygen.

18. (currently amended) A method according to claim 1, ~~2, 3 or 4~~ wherein the lignocellulosic material is a mechanical wood pulp and the reaction is carried out in a single-stage or multi-stage in one or more than one refiner, bleach tower, pulp mixer, a storage vessel, or any other reaction vessel suitable for performing the alkaline hydrogen peroxide bleaching of the pulp.

19. (currently amended) A method according to ~~any one of claims 1 to 10~~ claim 1, wherein the lignocellulosic material is wood chips and at least one of said reaction and bleaching is carried out in a single-stage or multi-stage in one or more than one impregnator.

20. (original) A method according to claim 19 wherein the impregnation of the wood chips is conducted at a temperature of 40 - 90 °C, a solid content of 30 - 60%, by weight, and an impregnation time of 5 minutes to 2 hours.

21. (currently amended) A method according to claim 1~~, 2 or 3~~ wherein the lignocellulosic material is a wood pulp and the reaction of said yellowing inhibitor with the pulp is carried out in an agitated tank or any other stock preparation vessels of a paper machine.

22. (canceled)

23. (canceled)

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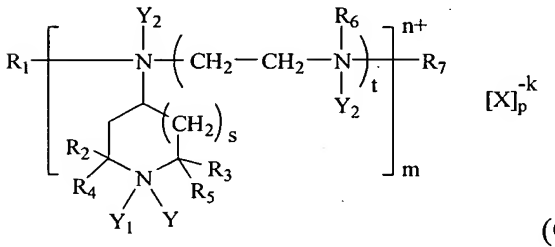
24. (currently amended) A paper sheet containing a pulp of a material of claim ~~22 or 23~~ 27.

25. (original) A paper sheet according to claim 24 containing said pulp as the sole pulp component.

26. (original) A paper sheet according to claim 24 containing said pulp in conjunction with a chemical pulp.

27. (original) A light stable lignocellulosic material having a yellowing inhibitor of formula (O):



(O)

wherein s is 0 or 1;
k is an integer of 1 to 5,
n is an integer of 0 to 5002, more preferably 0 to 502, even more preferably 0 to 52, and most preferably 0 to 12;
m is an integer of 1 to 5,
t is an integer of 1 or more, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;

p is an integer of 0 to 5002, more preferably 0 to 502, even more preferably 0 to 52, and most preferably 0 to12; provided that when n is 0, p is 0, m is 1, and both Y_1 and Y_2 are absent;

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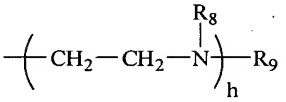
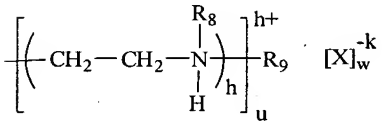
Y is oxyl (O˙), hydroxyl (OH) or hydrogen (H), and Y_1 is hydrogen or absent, provided that when Y_1 is hydrogen, Y is hydroxyl;
Y_2 is hydrogen or is absent, provided that when Y_2 is hydrogen, n = t + 1 or t + 2, and when Y_2 is absent, n is 0 or 1
R_2, R_3, R_4 and R_5 are independently alkyl groups $(CH_2)_jH$ unsubstituted or substituted by 1 to a (2j+1) number of substituents, selected from hydroxyl, mercapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or a radical derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by 1 to j number of heteroatoms selected from –O- and –S-, wherein j is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;.
R_1 is hydrogen or an ethylene amino or ammonium group of formula (I) or (J);
when $t \geq 2$, R_6 and R_7 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
when t = 1, R_6 is hydrogen and R_7 is a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N):



(I)



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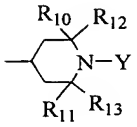
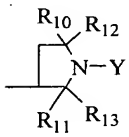
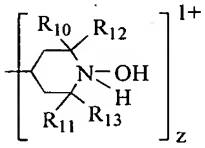


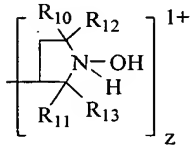
(K)



(L)



(M)



(N)

wherein h ≥ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
X is the same as defined above;
k is 1 to 5,
w is ≥1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10,
u = 1 to 5, the total charge kw = hu in formula (J);
R_8 and R_9 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
R_{10}, R_{11}, R_{12} and R_{13} are independently alkyl groups $(CH_2)_iH$ unsubstituted or substituted, by 1 to a (2i+1) number of substituents selected from, hydroxyl, mecapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or radicals derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by i heteroatoms selected from –O- and –S-, wherein i is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;

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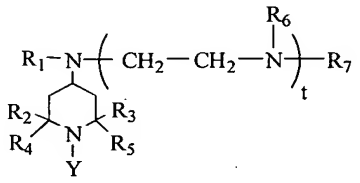
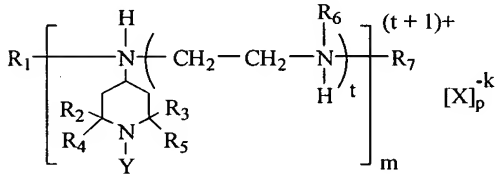
X is the same as defined above; k is 1 to 5, y is 1, z is 1 to 5, the total charge ky = z in formula (M) or (N); Y is oxyl (O·), hydroxyl (OH) or hydrogen (H).

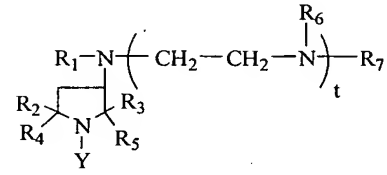
28. (original) A light stable lignocellulosic material according to claim 27 wherein said yellowing inhibitor of formula (O) is of formula A, B, C D, E, F, G or H wherein Y is oxyl (O·) or hydroxyl (OH) linked thereto via one or more than one secondary and/or tertiary amino or ammonium group, and/or quaternary ammonium group of the inhibitor:



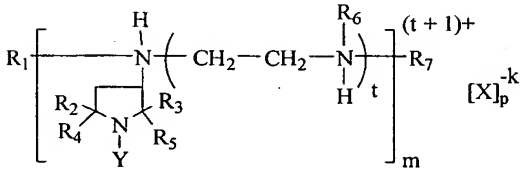
(A)



(B)



(C)



(D)

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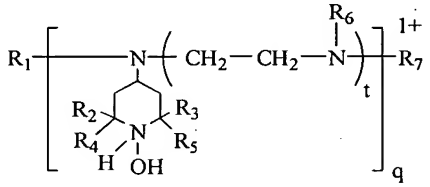
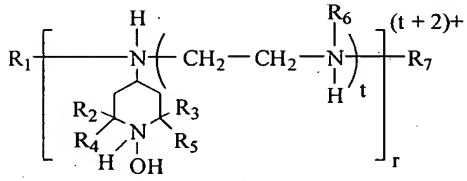
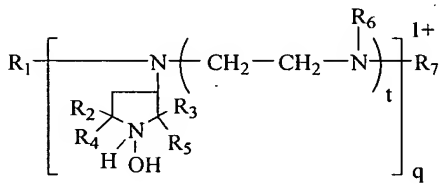


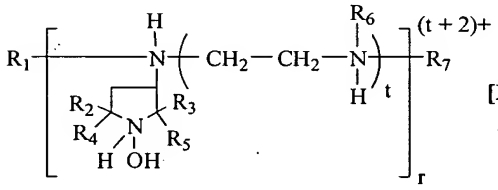
$[X]_p^{-k}$ (E)



$[X]_p^{-k}$ (F)



$[X]_p^{-k}$ (G)



$[X]_p^{-k}$ (H)

wherein R_2, R_3, R_4 and R_5 are independently alkyl groups $(CH_2)_jH$ unsubstituted or substituted by 1 to a (2j+1) number of substituents, selected from hydroxyl, mercapto, lower alkoxy, lower alkylthio, , benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or a radical derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by 1 to j number of heteroatoms selected from –O- and –S-, wherein j is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;
X is an inorganic or organic anion such as carbonate, bicarbonate, chloride, bisulfate, sulfate, formate, acetate, citrate, phosphate, oxalate, ascorbate, ethylenediaminetetraacetate, or diethylenetriaminepentaacetate;
k is 1 to 5,

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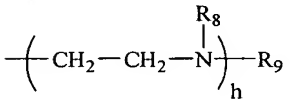
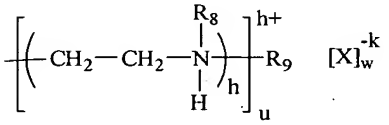
p is an integer of 1 to 5001, more preferably 1 to 501, even more preferably 1 to 51, and most preferably 1 to 11 in formula (B) or (D), p is 1 in formula (E) or (G), and p is 1 to 5002, more preferably 1 to 502, even more preferably 1 to 52, and most preferably 1 to 12 in formula (F) or (H),
m is 1 to 5,
q is 1 to 5,
r is 1 to 5,
the total charge of kp = (t + 1)m in formula (B) or (D), kp = q in formula (E) or (G), and kp = (t + 2)r in formula (F) or (H);
t is $\geq$ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
R_1 is hydrogen or an ethylene amino or ammonium group of formula (I) or (J);
when t $\geq$ 2, R_6 and R_7 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
when t = 1, R_6 is hydrogen and R_7 is a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N):



(I)



(J)

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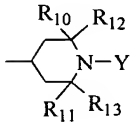
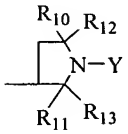
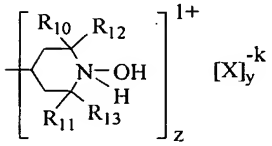


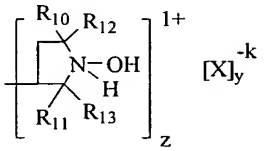
(K)



(L)



(M)



(N)

wherein $h \geq 1$, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10;
X is the same as defined above;
k is 1 to 5,
w is ≥ 1, preferably 1 to 5000, more preferably 1 to 500, even more preferably 1 to 50, and most preferably 1 to 10,
u = 1 to 5, the total charge kw = hu in formula (J);
R_8 and R_9 are independently hydrogen, a radical (functional group) derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole, or a radical (functional group) of the formula (K), (L), (M) or (N);
R_{10}, R_{11}, R_{12} and R_{13} are independently alkyl groups $(CH_2)_iH$ unsubstituted or substituted, by 1 to a (2i+1) number of substituents selected from, hydroxyl, mecapto, lower alkoxy, lower alkylthio, benzyl, amino, lower alkyl ester, amide, carboxyl and carboxylate groups, or radicals derived from an organic ultraviolet absorber such as 2,4-dihydroxybenzophenone or 2-(2-hydroxyphenyl)benzotriazole; and being uninterrupted or interrupted by i heteroatoms selected from –O- and –S-, wherein i is 1 to 14, preferably 1 to 6, and more preferably 1 to 4;

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X is the same as defined above; k is 1 to 5, y is 1, z is 1 to 5, the total charge ky = z in formula (M) or (N); Y is oxyl ($O^{\cdot}$), hydroxyl (OH) or hydrogen (H).

29. (original) A material according to claim 28 wherein the lignocellulosic material is a mechanical wood pulp.